

composed of lower quality basalt were likely fragments from groundstone tools, such as bird cooking stones, hammerstones and grinding stones. One hammerstone (Art. 92) is flaked into a disc-like shape with a finger indentation on one side.

The groundstone tools include hammerstones, possible bird cooking stones, abraders and a grinding stone (Figure 104). The hammerstones are represented by a wide variety of shapes and sizes sufficient for meticulous lithic reduction activities as well as the hammering of larger items. The bird cooking stones or *pōhaku ehu* are defined roughly by their bullet-like or phallic shape and some are battered, suggesting they were also used as hammerstones. The *pōhaku ehu* are commonly associated with Saddle and Mauna Kea sites and, in part, may be related to the high consumption of Hawaiian Petrels in the region. The *pōhaku ehu* are also considered to be sacred objects used in ceremony during the ascent and descent of Mauna Kea (cf. McCoy 1991:177):

The bird cooking stones in my view were employed to not just make contact with the gods, but to actually empower the consumer of the sacrifice...in this view the stones would have been used in rites performed on the ascent to the quarry, in the change from the *noa* to *kapu* state...

The basalt manuports consist of three waterworn rocks (Art. 95.1, 106.5, 112.2) and a basalt slab (Art. 64.1). The waterworn rocks have battered ends, suggesting they were used as hammerstones. The basalt slab, measuring 11.5 cm by 5.6 cm and 1.8 cm thick, has a scoriaceous surface on both sides and volcanic glass is visible in the breaks on the sides of the slab. The item was undoubtedly extracted from volcanic glass exposures in the nearby k4 flow.

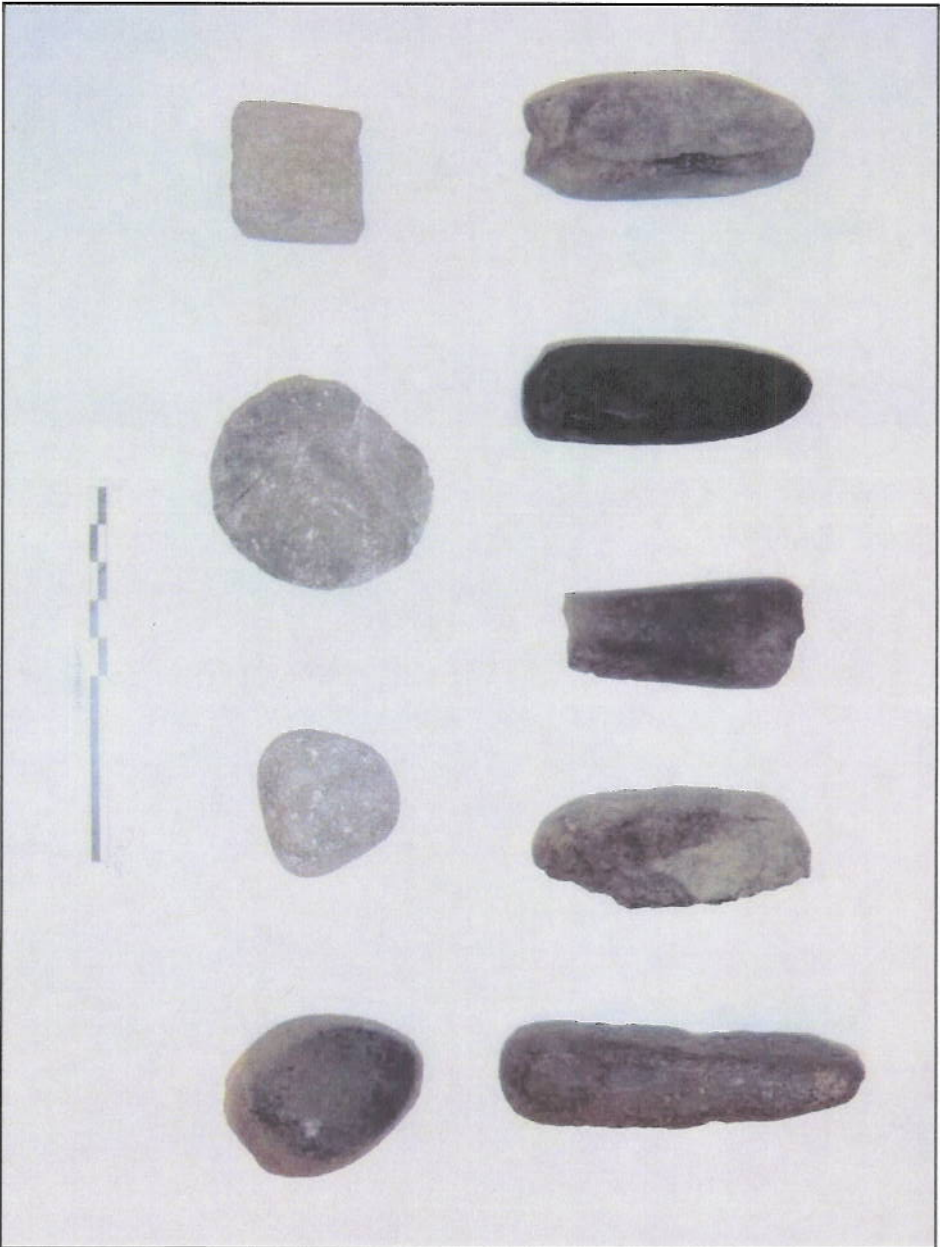
#### **Volcanic Glass Tools**

Fifty-six volcanic glass artifacts were recovered from the sites, including 14 cores and 38 edge-altered flakes (Figure 105). The glass cores are relatively small, averaging 3 cm in diameter, and typically contain a veneer (roughly 5-10 mm thick) of glass on the flaked and convex portion of the core. Twenty-three of the edge-altered flakes (60%) are blade-like in shape and have two opposing sharp edges, both of which are often reworked and utilized. Some of the blade flakes contain a ropey lava cortex on the convex exterior and others have a right angle exterior (triangular in cross-section) with the lava cortex on one adjoining plane. The usewear on most of the glass flakes is minor, possibly indicating a limited use of the cutting or scraping tools, or the softness or brittleness of the material being cut or scraped (e.g., bird bones or feathered hides).

#### **Lithic Debitage**

Lithic debitage, defined as "residual lithic material resulting from tool manufacturing" (Crabtree 1972:58), is classified in this analysis as either shatter or flake. For potential comparisons, flake sizes were grouped in size ranges that correspond with Ogden's debitage analysis of materials from nearby PTA sites (Williams 2002:93). The size ranges used are: 0-10 mm; 10-20 mm; 20-40 mm, 40-60 mm, 60-80 mm and greater than 80 mm. The quantities of the smallest flakes and shatter (0-10 mm) were estimated.

Approximately 3,495 pieces of lithic debitage, including volcanic glass (80%) and basalt (20%) are included in the lithic debitage. The majority of the debitage (87%) consists of shatter or fragments lacking discernable flake characteristics. Most of the volcanic glass flakes (93%) and basalt flakes (96%) are between 10-40 mm in size. The shatter is predominantly smaller than the flakes, with 77% falling in the 0-10 mm range (Figure 106).

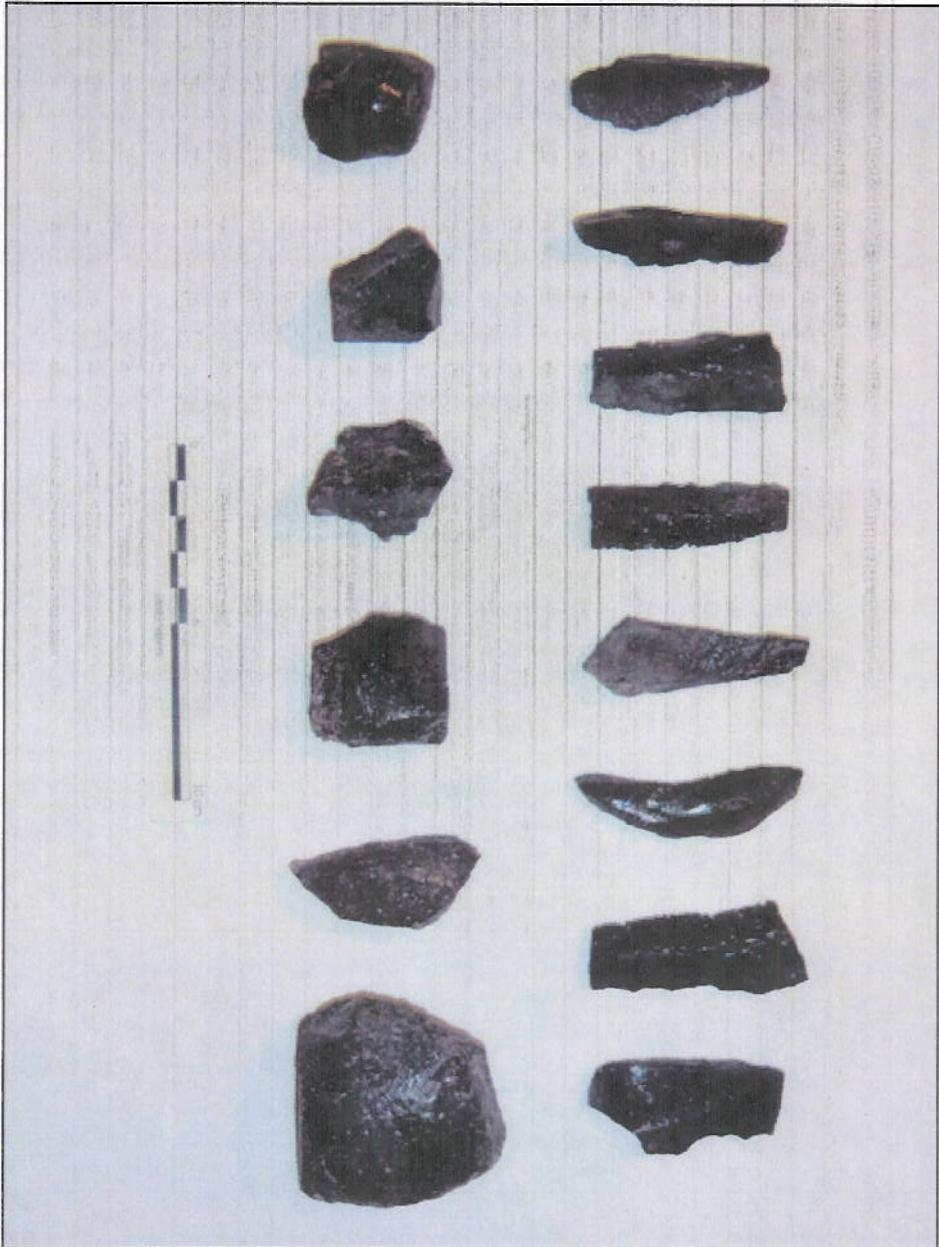


**Figure 104. Basalt Artifacts**

Upper Row (L to R): Bird-Stones (Art 96, 102, and 111); Bird-Stone/Hammerstone (Art 102); Grinding Stone (Art 106.4)

Lower Row (L to R): Bird-Stone (Art 92.4); Hammerstone (Art 92.1); Abrader (Art 85.1); Bird-Stone/Hammerstone (Art 2.1)





**Figure 105. Volcanic Glass Artifacts from Site 19490**

Upper Row (L to R): Blade Flakes (Art. 93.12, 93.13, 93.2, 93.14, 93.15, 93.11, 93.1, 93.3);

Lower Row (L to R): Cores (Art. 93.23, 93.12, 93.20, 93.18, 93.26, and 49.1)

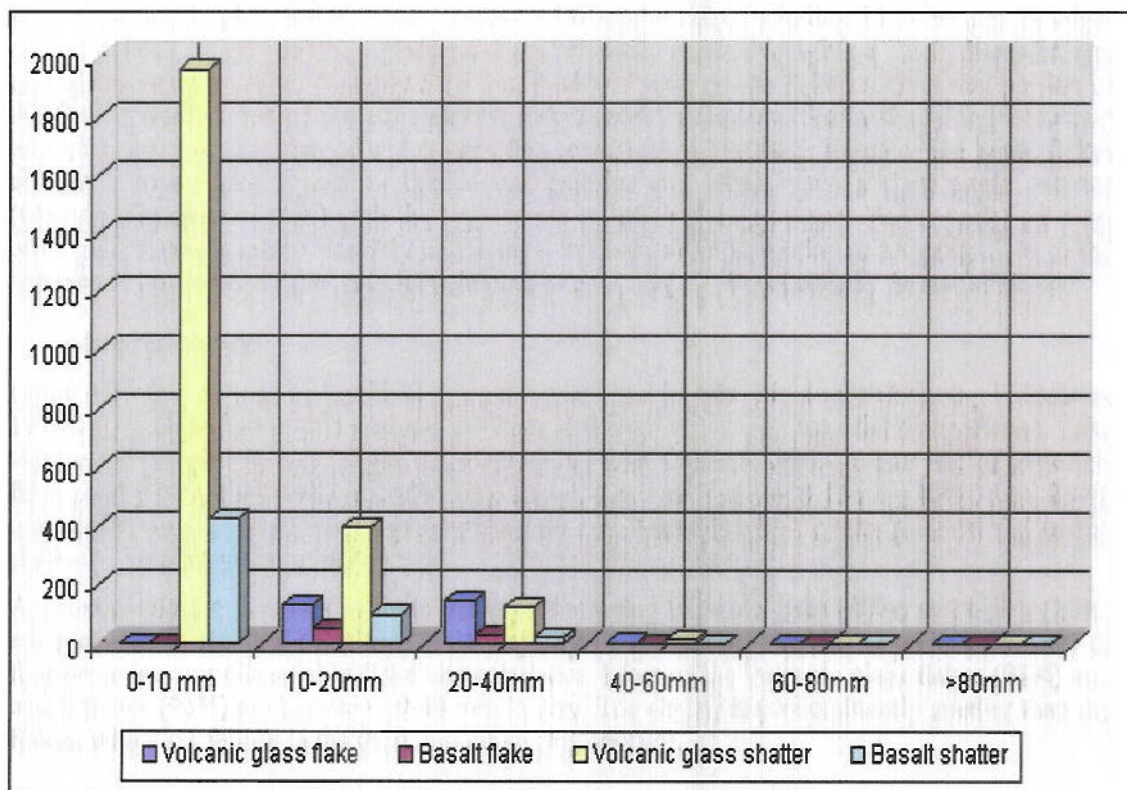


Figure 106. Lithic Debitage Frequencies by Classification, Size and Material

### 7.2.2 Marine Shell

Fourteen 'opihi shells (*Cellana sanwicensis*) were recovered from Site 19490. All 14 shells had worn perimeters indicative of scraping or cutting activities (Figure 107). Two of the shell tools (Art. 63.1 and 86.1) with perforations might also be pendants. Shell scrapers were typically used for removing skins from taro and breadfruit (Buck 2003:22); though it is unlikely either food items were being processed in the remote Saddle Area.

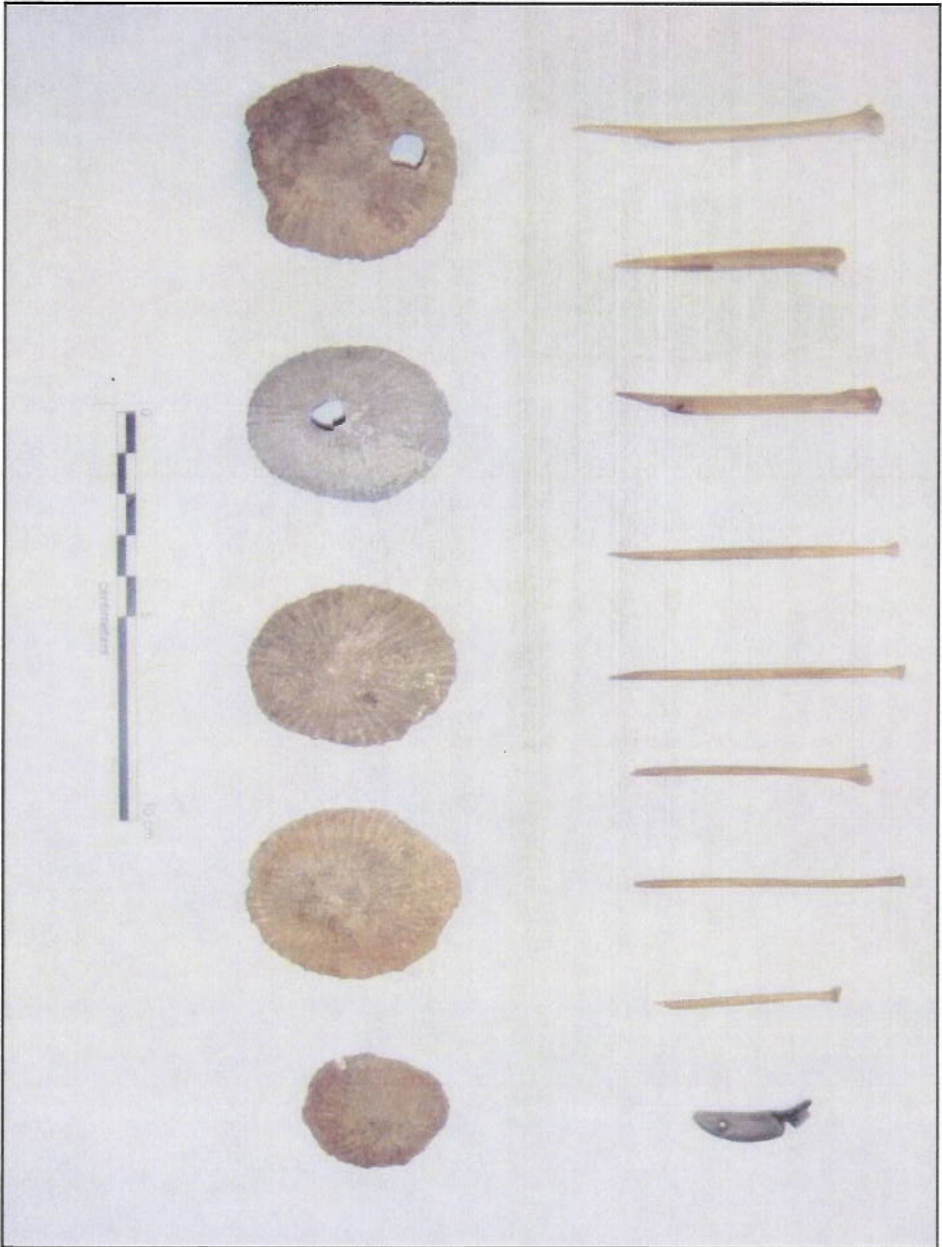
### 7.2.3 Bone Artifacts

Twenty-three bone artifacts were included in the faunal collection discussed below. All 23 of the items were recovered from Site 19490 and include one dog tooth pendant (Art 93.39) and the rest are modified bird limbs from medium birds or procellariids likely used as picks or awls (see Figure 107). Ziegler (2003) suggests the awls or picks were used for plaiting or weaving *hala* (*Pandanus odoratissimus*) or *makaloa* (*Cyperus laevigatus*) leaves. The implements may have also been used to repair sandals, such as the *ti* leaf sandals (*kama'a ti*) once present at Site 19490.

## 7.3 FAUNAL ANALYSIS

A total of 1,637.15 gms of vertebrate faunal remains was recovered from four of the project sites (Sites 19490, 21299, 23464, and 23626) and submitted to Dr. Alan Ziegler for zoological identification. The vertebrate remains were categorized to the lowest taxonomic level possible. Dr. Ziegler's summary report and faunal classifications are presented in Appendix A, as well as a faunal catalog summarized by lowest provenience. Table 19 provides a catalog of the faunal remains grouped by site.





**Figure 107. Bone and Shell Artifacts from Site 19490**

Upper Row (L to R) Bone Picks or Needles (Art. 113.15-115.22), Dog Tooth Pendant (Art. 93.39);

Lower Row (L to R): 'Opili' Shell Scrapers (Art. 63.1, 86.1, 105.2, 110.1, and 112.1)

Table 19. Volume and Weight of Faunal Remains Grouped by Site

Site	19490	21299	23464	23626
Volume (m3)	0.342	0.006	0.007	0.062
<b>AVES</b>				
<i>Asio flammeus</i>	0.75		0.1	
<i>Branta sanwicensis</i>	1.1			
Galliform (large)	0.1			
<i>Oceanodroma castro</i>	0.2			
<i>Porzana sp.</i>	1.5			
<i>Pterodroma phaeopygia</i>	52.3	0.3	0.5	9.1
Passeriform (small)	0.55			0.05
Procellariid (small)	14.5	0.1		1.1
Procellariid (medium)	213.2	1.3	2.9	4.9
Eggshell fragment	2.7			
Small bird	0.35			
Medium bird	1,161	4.2	0.8	41.5
Large Bird	2.35			0.4
Medium bird egg shell	1.9			
<b>Total Aves</b>	<b>1450.6</b>	<b>5.9</b>	<b>4.3</b>	<b>58.95</b>
<b>MAMMALIA</b>				
<i>Canus familiaris</i>	0.1			
<i>Capra hircus/Ovis sp.</i>	20.8			
<i>Herpestes auropuctatus</i>	2.7			
<i>Rattus exulans</i>	3.35			0.05
<i>Rattus Norvegicus/Rattus rattus</i>	0.05			
Mammal (small)	5.4			
Mammal (medium)	83			
<b>Total Mammalia</b>	<b>115.4</b>	<b>0</b>	<b>0</b>	<b>0.05</b>
<b>OSTEICHTHYES</b>				
Unidentified fish	0.45			
<b>VERTEBRATE (medium)</b>	<b>1.5</b>			

Bird bone represents 93 percent (1,519.75 gms) of the faunal remains, with most (95%), including all types represented, and recovered from a 1 m by 1 m unit at Site 19490. The most common bird bone identified at all four sites is Hawaiian Petrel (*Pterodroma phaeopygia*) (92.2 gms), also likely represented as medium procellariid (222.3 gms) and medium bird (1,207.5 gms). Some of the Hawaiian Petrel bones exhibit "end breakage," suggesting a specialized butchering technique that separated the bird skeletons with a sharp edged tool, such as a basalt or volcanic glass tool (Ziegler 2003). Ziegler also noted the splintering of pedal phalanges, which he suggests was caused by humans chewing the bird's feet and spitting out the bony remains. The small size of fishbone recovered from 19490 might represent stomach contents of the Hawaiian Petrel recently captured in the Saddle Region after feeding at the ocean (Ziegler 2003). The presence of egg shell fragments may also indicate Hawaiians were actively collecting eggs from nearby burrows or nests used by the Hawaiian Petrel, Hawaiian Goose or Short-eared Owl, or they were obtained in the ovum of Hawaiian Petrels after the birds were captured for consumption (Ziegler 2003).

Lesser amounts of small procellariid (Gracile or Bonin Petrel) and Band-rumped Storm Petrel (*Oceanodroma*) (0.2 gm) were recovered at Sites 19490, 21299, and 23626. The small procellariid, becoming extinct shortly before Western Contact, were likely captured at the coast and carried to the Saddle Area for consumption. The remains are much more fragmented and highly burned than the predominant Hawaiian Petrel, suggesting the smaller birds were deposited in the hearth at an earlier time and continuously re-burned during subsequent uses of the hearths (Ziegler 2003). Scant amounts of short-eared owl or pueo (*Asio flammeus*) (0.85 gm), Hawaiian



goose or *nene* (*Branta sanwicensis*) (1.1 gms), perching bird or songbird (small passeriform), and the extinct Hawaiian Flightless Rail (*Porzana* sp.) reveals opportunistic bird catching as opposed to organized hunting (Ziegler 2003).

Mammal bone recovered from Site 19490 and 23626 consists of 0.1 gm of dog (*Canus familiaris*), Polynesian Rat (*Rattus exulans*), introduced Goat or Sheep (*Capra hircus/Ovis* sp.), Mongoose (*Hesperetes auropunctatus*) and Norwegian or Roof Rat (*Rattus norvegicus* or *Rattus rattus*).

#### 7.4 RADIOCARBON DATING ANALYSIS

Radiocarbon analysis was conducted on charcoal samples from distinct subsurface or surface hearths identified at Sites 19490, 21285, 21299, and 23626. All four sites are lava tube habitations; three of the sites are limited use occupations and one (Site 19490) is a repeated use occupation.

Each sample was screened by Ms. Gail Murakami, of International Archaeological Research Institute, Inc., for short-lived plant species. The screening identified only native plants and trees, including 'a'ali'i (cf. *Dodonaea viscosa*), 'akoko (*Chamaesyce* spp.), *mamane* (cf. *Myoporum sandwicense*), *naio* (cf. *Myoporum sandwicense*) *pūkiawe* (cf. *Styphelia tameiameia*), and *ōhia lehua* (cf. *Metrosideros polymorpha*). All of these trees and bushes are native to the Saddle Area.

Ten individual samples (Beta Nos. 185341-185340) from the four sites were submitted to Beta Analytic, of Miami Florida, for radiocarbon analysis and calibration (Appendix B and Table 20). For comparative purposes, the radiocarbon samples selected from each of the four sites also included multiple wood species from the same provenience. Depending on the quantity of carbon present, the radiocarbon ages were calculated using standard radiometric methods or accelerator-mass-spectrometer (AMS) methods. The results of the radiocarbon dating analysis are discussed below.

##### 7.4.1 Site 19490

Four carbon samples (Beta 185337-185340) were analyzed from a deeply stratified hearth feature (SF1) inside the light-zone of Site 19490 (Feature C) lava tube. The hearth contained an abundance of food remains (chiefly bird) and tools related to food preparation and lithic reduction activities. Three of the samples consisted of 'akoko, *naio* and *mamane* from an upper component (d) of SF1 and *naio* from the lowest component (f) of SF1.

The three wood samples from SF1d produced different calibrated date ranges. The 'akoko sample had a radiocarbon age of  $100 \pm 40$  BP, calibrated ( $2\sigma$ ) to a single date range of AD 1480-1660. The *naio* produced a radiocarbon age of  $240 \pm 50$  BP, calibrated ( $2\sigma$ ) to three date ranges spanning AD 1490-1950. The *mamane* produced a radiocarbon age of  $120 \pm 40$ , calibrated ( $2\sigma$ ) to two date ranges spanning AD 1650-1960. The *naio* sample from SF1e, a burning component at the base of the hearth, produced a radiocarbon age of  $300 \pm 50$ , calibrated ( $2\sigma$ ) to a date range of AD 1450-1660. Given the absence of post-Contact cultural materials, the hearth was likely used during the pre-Contact period, specifically between the late 1400s and mid 1600s – as suggested by the two single date ranges obtained from both hearth components.

##### 7.4.2 Site 21285

Two carbon samples (Beta 185341) were analyzed from a shallow charcoal concentration (SF1) inside the lava tube of Site 21285. Because of its shallow deposit and lack of associated food remains, SF1 is interpreted as a limited or one-time use hearth probably used for light or warmth inside the tube. One of the samples consisted of *ōhia lehua* that produced a radiocarbon age of

Table 20. Radiocarbon Dating Analysis and Wood Species Identification

Beta Sample No.	Site No.	Feature	Depth (Cmbs)	Measured Radiocarbon Age (BP)	C13/C12 Ratio	Conventional Radiocarbon Age	Calibrated Age (2 Sigma)	Identified Wood Species
185341	21285	1	Surface	830+/-40	-26.2 o/oo	810+/-40 BP	A.D. 1170-1280	'ōhi'a lehua (cf. <i>Metrosideros polymorpha</i> )
185342	21285	1	Surface	740+/-40	-25.9 o/oo	730+/-40 BP	A.D. 1240-1300	pūliawe (cf. <i>Styphelia tameiameia</i> )
185333	21299	1	0-2/7	220+/-50	-24.6 o/oo	230+/-50 BP	A.D. 1520-1580; A.D. 1630-1690; A.D. 1730-1810; A.D. 1920-1950	naio (cf. <i>Myoporum sandwicense</i> )
185334	21299	1	0-2/7	240+/-40	-23.5 o/oo	260+/-40	A.D. 1520-1590; A.D. 1620-1670; A.D. 1770-1800; A.D. 1940-1950	pūliawe (cf. <i>Styphelia tameiameia</i> )
185335	23626	1	10-12/23	190+/-40	-23.1 o/oo	220+/-40	A.D. 1640-1680; A.D. 1730-1810; A.D. 1930-1950	'a'ali'i (cf. <i>Dodonaea viscosa</i> )
185336	23626	1	10-12/23	200+/-40	-24.1 o/oo	210+/-40	A.D. 1640-1690; A.D. 1730-1810; A.D. 1920-1950	naio (cf. <i>Myoporum sandwicense</i> )
185337	19490	1d	15	100+/-40	-12.8 o/oo	300+/-40	A.D. 1480-1660	'akoko (cf. <i>Chamaesyce</i> spp.)
185338	19490	1d	15	240+/-50	-22.9 o/oo	270+/-50 BP	A.D. 1490-1680; A.D. 1770-1800; A.D. 1940-1950	naio (cf. <i>Myoporum sandwicense</i> )
185339	19490	1d	15	120+/-40	-22.2 o/oo	170+/-40 BP	A.D. 1650-1890; A.D. 1910-1950	manane (cf. <i>Sophora chrysophylla</i> )
185340	19490	1f	41	300+/-50	-23.1 o/oo	330+/-50 BP	A.D. 1450-1660	naio (cf. <i>Myoporum sandwicense</i> )



830±40 BP, calibrated (2σ) to AD 1170-1280. The other sample, *pūkiawe*, produced a radiocarbon age of 740±40 BP, calibrated (2σ) to AD 1240-1300.

#### 7.4.3 Site 21299

Two carbon samples, consisting of *naio* and *pūkiawe* wood, were analyzed from a surface hearth in the entrance of Site 21299 lava tube. Both wood species (with radiocarbon ages of 220±50 BP and 240±40, respectively) produced multiple (2σ) calibrated date ranges spanning between 1520 and 1950. Given the absence of post-Contact materials, the hearth was likely utilized during the pre-Contact period, but not earlier than the mid 1500s.

### 8.0 SUMMARY OF FINDINGS

In accordance with the Scope of Work, the main goal of the Phase II work was to collect adequate data from the project sites to evaluate significance and eligibility to the NRHP. These evaluations are made for all sites in the project area and are provided in the *Significance Evaluations* (Section 9.0) of this report.

Three main site types, occupation, transportation and resource procurement, are indicated in the archaeological record that typify traditional Hawaiian land use and settlement patterns on the upland plateau or Saddle Region of Hawai'i Island. These themes correspond to the *Historic Context* (Section 4.0) developed previously in this report and include archaeological features indicative of occupation, possible bird catching, stone quarrying and transportation.

#### 8.1 SITE DISTRIBUTION

Sites are distributed across the project area on types of lava flow that support the function of the site (Figure 108). Most of the occupation sites are found in *pāhoehoe* lava flows (k1o and k2 flows) where sizable caverns are created in lava tubes or blisters. Possible bird catching pits occur in older or more weathered *pāhoehoe* flows (k1o and k2) with subterranean cavities (lava blisters or tubes) suitable for bird nesting. Volcanic glass is quarried from the surface of the k3 flow restricted to the center of the project area. A single basalt quarry is located on the outer edge of an *a'a* flow also associated with the k3 flow. Possible transportation routes, evidenced by foot trails and rock markers, occur in a portion of *a'a* lava in the k2 flow and on a cinder cone (Pu'u Kulua) at the center of the project area.

#### 8.2 SITE FUNCTION

Of the 24 sites present in the project area, 10 are classified as occupation sites, 10 are related to resource procurement activities (quarries and possible bird catching pits) and four sites (including a trail at Site 19490) are possible trails or trails markers (Table 21). Each of these three function categories are summarized below.

##### 8.2.1 Occupation

Nine of the occupation sites are located in or contain complexes that include lava tubes or blisters (Sites 18671, 18673 19490, 21285, 21299, 21308, 23464, 23625, and 23626,) and one site is a single enclosure (Site 23456). The occupation sites were short-term habitation sites that can be classified as limited-use or repeated-use occupations according to criteria previously established for PTA sites (cf. Streck 1992). A habitation function is indicated at the project sites by the presence of hearths, cultural material or architectural components. All of the occupation sites are located in close or relative proximity to potential resource areas, such as quarries and possible bird catching pits. Six of the sites (Sites 18671, 18673, 21299, 23464, 23456 and 23626) contain definitive cultural material associated with procurement of these two local resources (e.g., volcanic glass, bird cooking stones and/or bird bone midden and tools). Site 19490 also lies at the juncture of two trails extending west and south of the site.



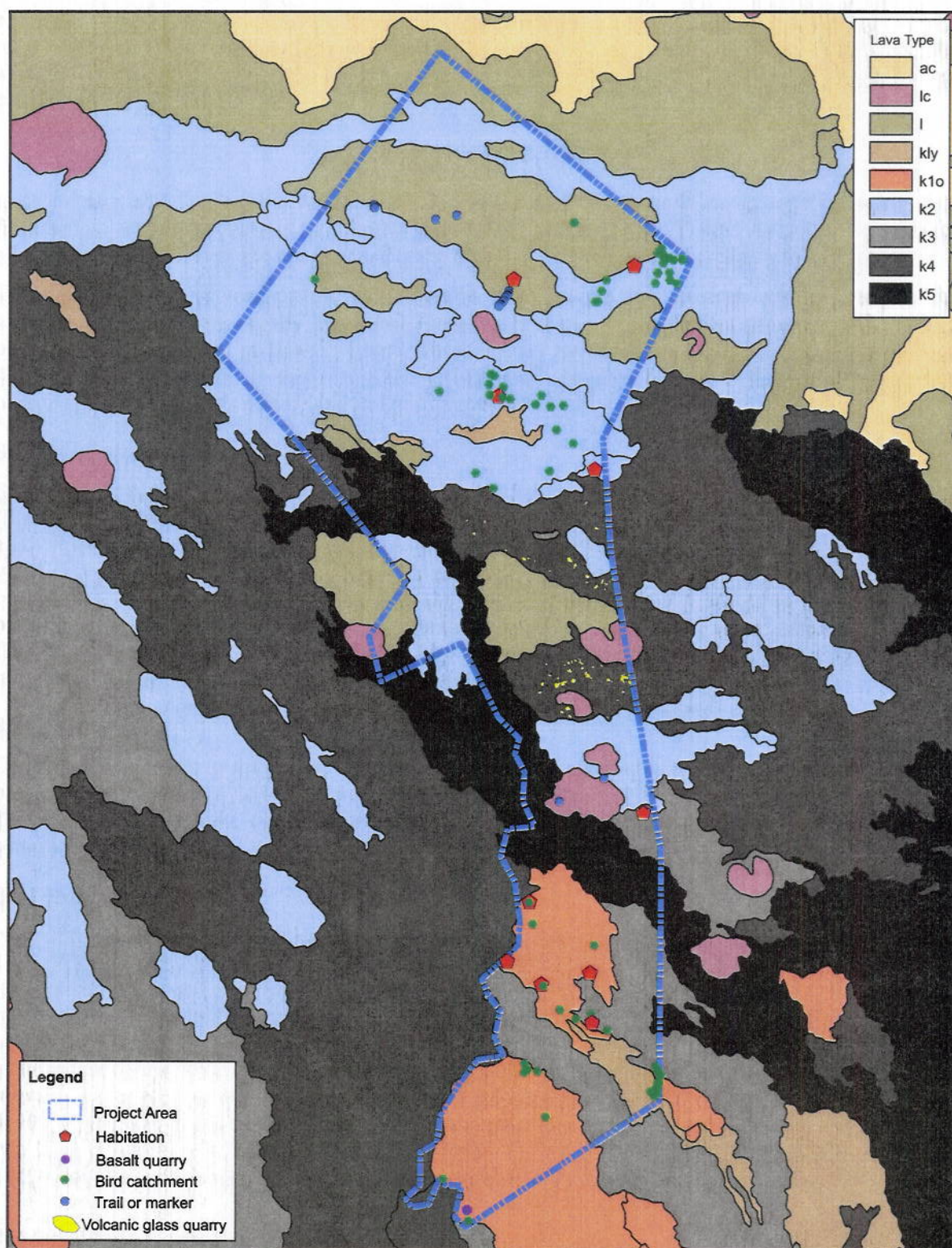


Figure 108. Distribution of Site Types on Lava Flow Map (Source: Wolfe and Morris 1996)